Balsam fir

(*Abies balsamea*)

Balsam fir has been declining in recent years but may be showing signs of recovery. For instance, the **number of pole and sawtimber trees has decreased** steadily since 1983 but the number of seedlings and saplings has increased.

Growth rates have declined and **mortality has increased**. Whereas balsam fir accounts for 2% of total tree volume in Wisconsin, it represents 10% of total mortality and only 1% of net growth. The ratio of removals to growth is 101% which means that **we are harvesting more wood than is being replaced.**

Balsam fir, located mostly in northern Wisconsin, is **not a major timber producing species**. It is used mainly for pulpwood and Christmas trees. Wood density is very low and may not **be a major source of biofuel**.

- *How has the balsam fir resource changed?*
  Growing stock volume and diameter class distribution: 1983, 1996, and 2008
- *Where does balsam fir grow in Wisconsin?*
  Growing stock volume by region with map
- *How fast is balsam fir growing?*
  Average annual net growth by region and year: 1983, 1996, and 2008
- *How healthy is balsam fir in Wisconsin?*
  Average annual mortality: 1983, 1996, and 2008
- *How much balsam fir do we harvest?*
  Roundwood producton by product and year: 1997, 2003, and 2006
- *How much is balsam fir selling for?*
  Prices for cordwood and sawtimber: 2000 to present
- *How much balsam fir biomass do we have?*
  Oven-dry tons by region of the state

"How has the balsam fir resource changed?"

Growing stock volume and diameter class distribution

The growing stock volume of balsam fir in Wisconsin in 2008 (Chart 1) was about 402 million cft or 2% of total statewide volume. This has decreased by 27% since 1983 and 15% since 1996.

The volume of growing stock has decreased since 1983 (Chart 2), 58% for large trees (over 13 inches dbh) and 25% for small trees (5 to 13 inches dbh).

The number of seedlings and saplings (Chart 3), however, has increased 30% in the last 10 years, suggesting that balsam fir may remain a vital part of Wisconsin's forests in the future.

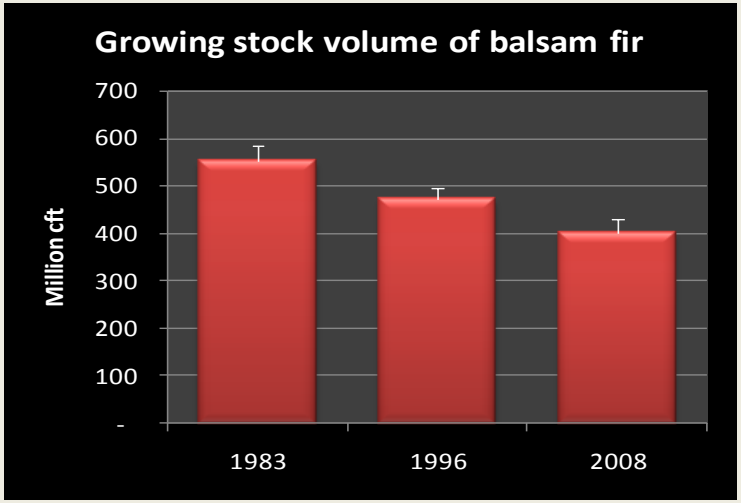


Chart 1. Growing stock volume (million cubic feet) by inventory year.
Source: USDA Forest Inventory and Analysis data: 1983, 1996, and 2008.

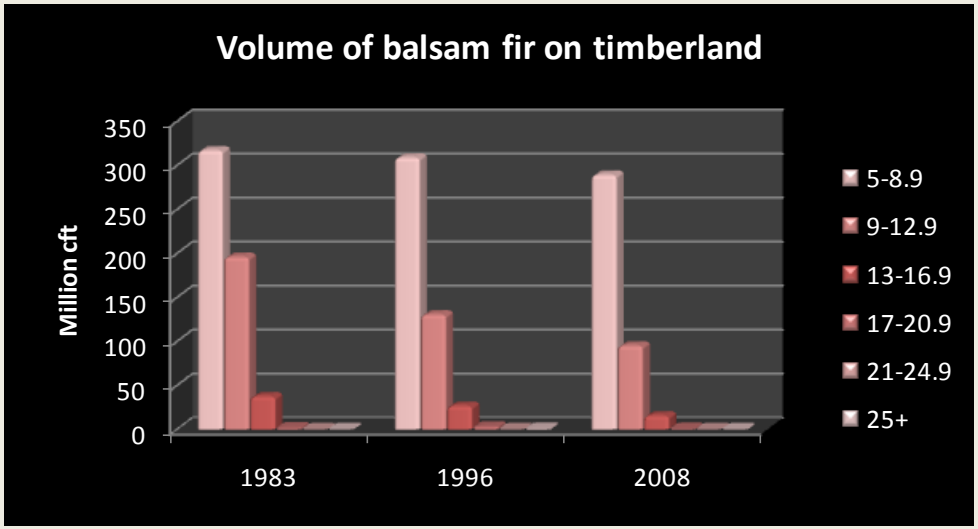


Chart 2. Growing stock volume (million cubic feet) in 1983, 1996, and 2008.
Source: USDA Forest Inventory and Analysis data: 1983, 1996, and 2008.

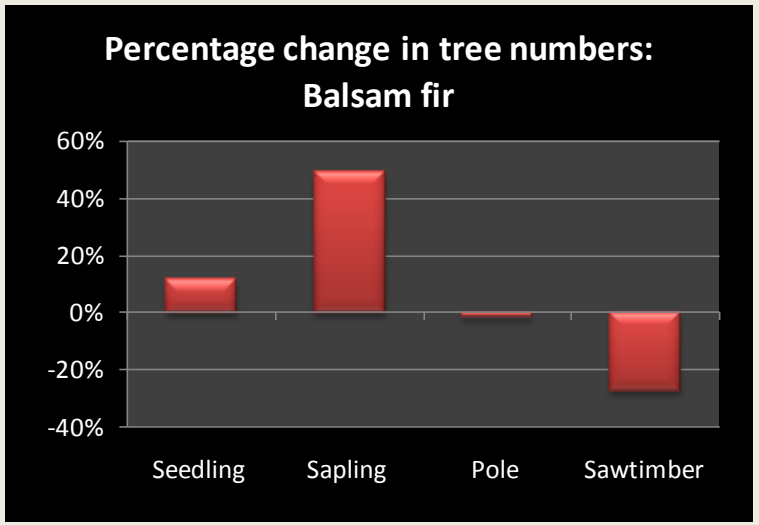
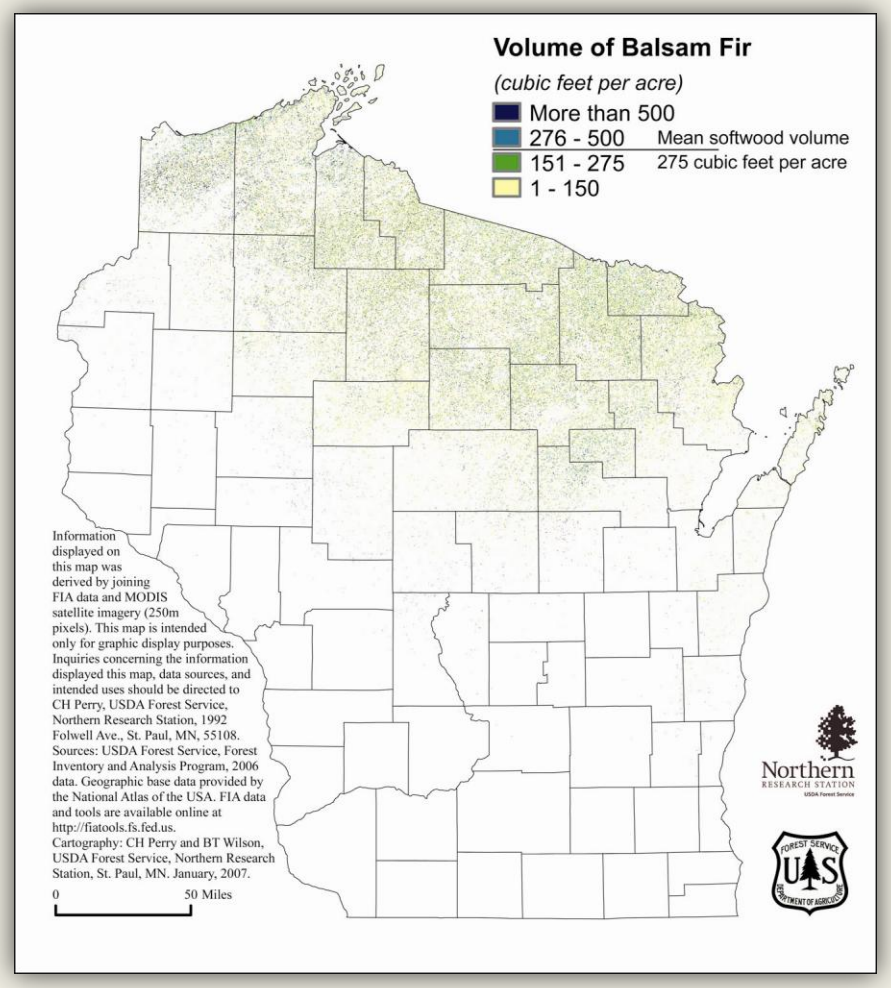


Chart 3. Percentage change in the number of live trees by size class between 1996 and 2008.
Source: USDA Forest Inventory and Analysis data 1996, and 2008.

"Where does balsam fir grow in Wisconsin?"

Growing stock volume by region with map



Source: North Central Forest Research Station USDA FS, St Paul MN

About 97% of all balsam fir volume is located in northern Wisconsin (Table 1). It is found about equally in aspen-birch forest types and in spruce-fir forests.

Table 1. Growing stock volume (million cft) by species and region of the state.

Species	Central	North east	North west	South east	South west	Total
Balsam fir	13	187	199	3	-	**402**
% of total	**3%**	**47%**	**50%**	**1%**	**0%**	**100%**

Source: USDA Forest Service, Forest Inventory and Analysis 2008 data

Additional tables:

Volume by county in 2008 (pdf; Excel)

"How fast is balsam fir growing?"

Average annual net growth by region and year

Rates of average annual net growth (Chart 4) have decreased by 76% in the last two decades, from 22.3 million cft per year in 1983 to 5.4 million cft/year in 2004 to 2008. Balsam fir accounts for less than 1% of total volume growth statewide.

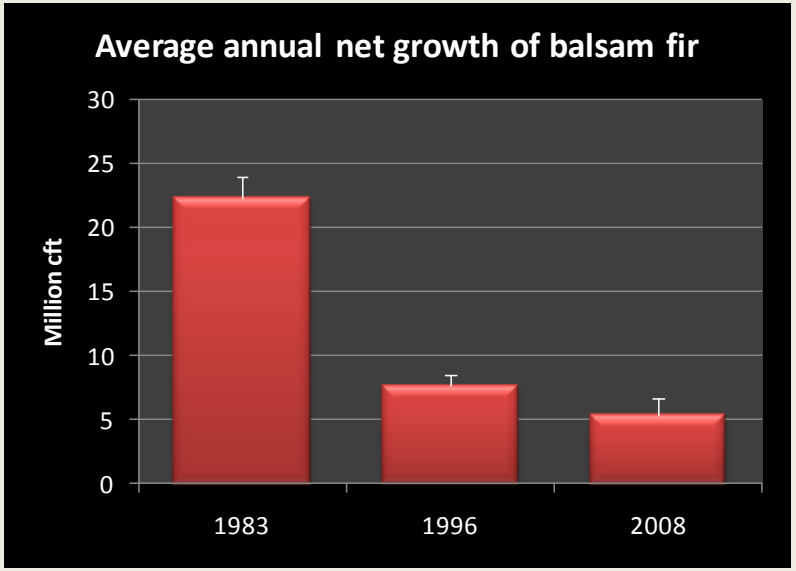


Chart 4. Average annual net growth (million cubic feet).
Source: USDA Forest Inventory & Analysis data: 1983, 1996, 2008

Table 2. Average annual net growth (million cft/year) and ratio of growth to volume by region of the state.

Region	Net growth	Percent of total	Ratio of growth to volume
Central	0.1	3%	1.1%
Northeast	3.4	64%	1.8%
Northwest	1.8	34%	0.9%
Southeast	0.0	-1%	-1.3%
Southwest	0.0	0%	.
Statewide	**5.4**	**100%**	**1.3%**

Source: USDA Forest Inventory and Analysis 2008.

As with volume, almost all growth for balsam fir is in the northern half of the state (Table 2). The average ratio of net growth to volume for balsam fir is 1.3%, **much lower than the statewide average** of 2.8% for all species.

Additional tables:
Average annual growth, mortality and removals by region (Pdf, Excel).

"How healthy is balsam fir in Wisconsin?"

Average annual mortality: 1983, 1996, and 2008

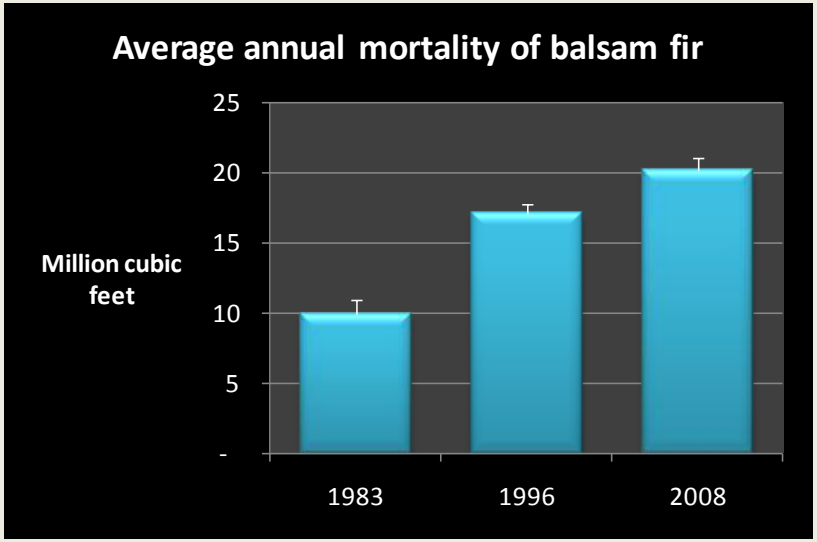


Chart 5. Average annual mortality (million cubic feet) by inventory year.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, 2008

Average annual mortality of balsam fir, over 20 million cft, accounts for 10% of all mortality in the state. This rate has doubled since 1983. Balsam fir makes up only 2% of total volume statewide but 10% of all mortality.

The ratio of mortality to gross growth is about 79% for balsam fir (Table 3). This is **3 times higher than the average** for all species in Wisconsin which is 26%.

Table 3. Mortality, gross growth, and the ratio of mortality to gross growth.

Species	Average annual mortality (cft)	Average annual gross growth (cft)	Mortality / growth
Balsam Fir	20,124,906	25,513,073	**79%**

Source: USDA Forest Inventory & Analysis data: 2008

Additional tables:
Average annual growth, mortality and removals by region (Pdf, Excel).

"How much balsam fir do we harvest?"

Roundwood production by product and year

In 2003, Wisconsin produced about 8.3 million cft of balsam fir roundwood or about 2% of total roundwood production (Chart 6). At that time, pulpwood made up 91% of the total.

In 2006, balsam fir pulpwood accounted for 3.6% of statewide production a decrease of 25% since 1997.

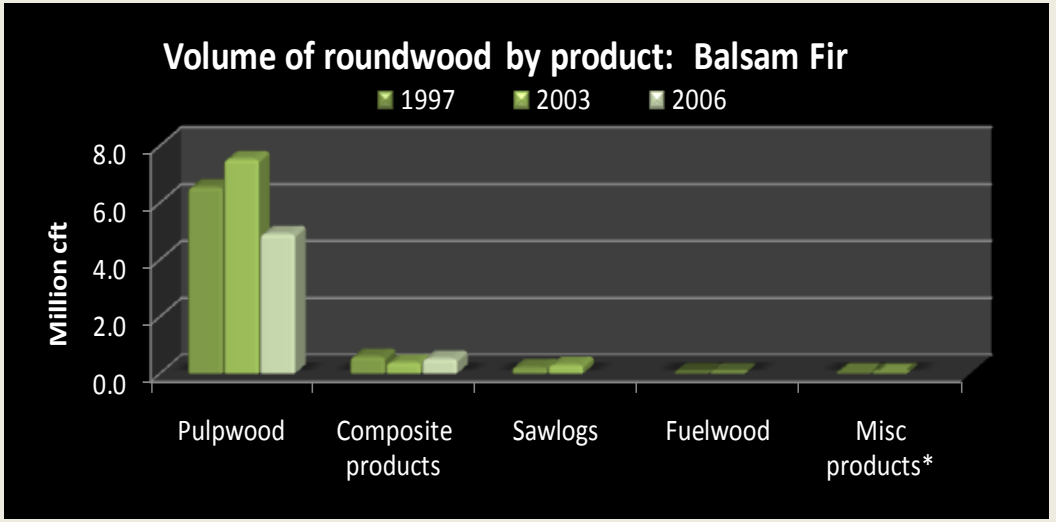


Chart 6. Volume of roundwood products. Numbers for pulpwood and composite products are from 2006. Numbers for sawlogs, fuelwood and miscellaneous products are from 2003 (Ron Piva).
* Miscellaneous products include poles, posts, pilings and veneer.
Source: Timber Products Output Mapmaker, http://ncrs2.fs.fed.us/4801/fiadb/rpa_tpo/wc_rpa_tpo.ASP

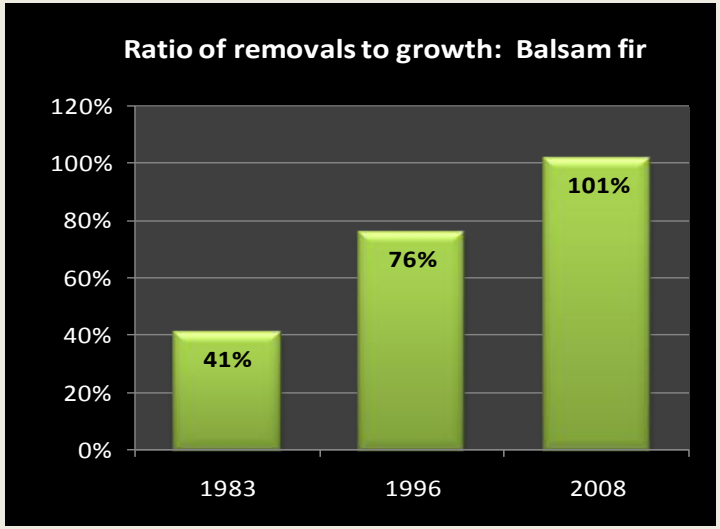


Chart 7. Ratio of volume harvested annually to net growth (2004 to 2008).
Source: USDA Forest Inventory & Analysis data: 1983, 1996, 2008.

The ratio of average annual removals to annual net growth (Chart 7) was 101% from 2004 to 2008, much higher than the statewide average of 56% for all species. Since removals are very low, this is mainly due to very low growth rates and high mortality. A ratio over 100% means that we are harvesting more balsam fir than is being replaced by normal growth (sampling error may alter this assumption).

Additional tables:
Average annual growth, mortality and removals by region (Pdf, Excel).

"How much is balsam fir selling for?"

Prices for cordwood and sawtimber: 2000 to present

Due to the variability of timber prices from year to year and region to region, two methods of reporting prices are presented here: Timber Mart North and the weighted average stumpage prices from Wisconsin Administrative Code Chapter NR 46 (table below).

Prices for cord and sawtimber products, as reported in the Timber Mart North have generally declined since 2000 (Chart 8).

Average weighted stumpage values, as reported in administrative code, have varied depending on the product and year. Sheared Christmas trees are a major product for balsam fir. Although most balsam fir is priced far below other softwoods, sheared trees receive

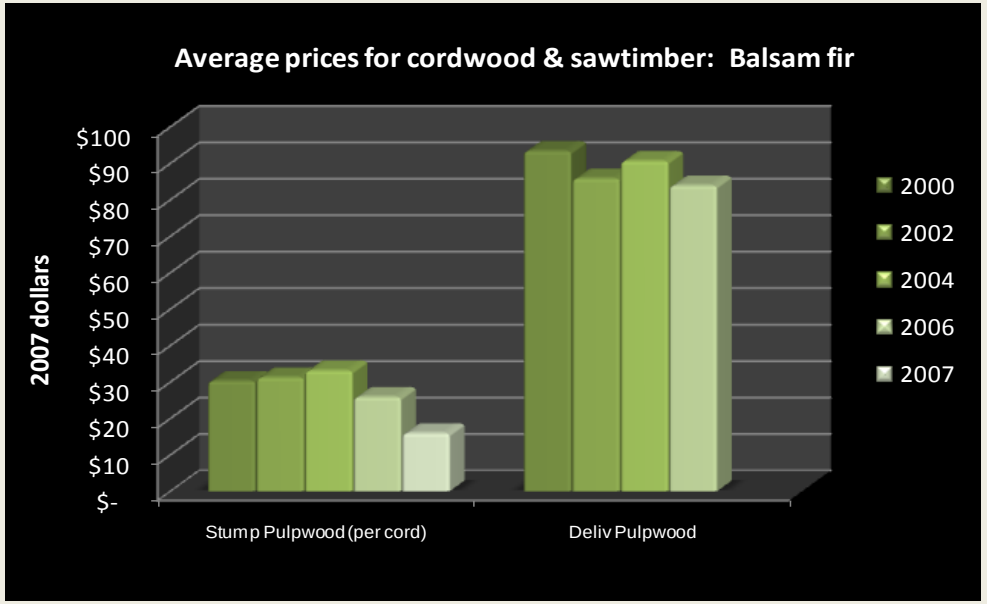
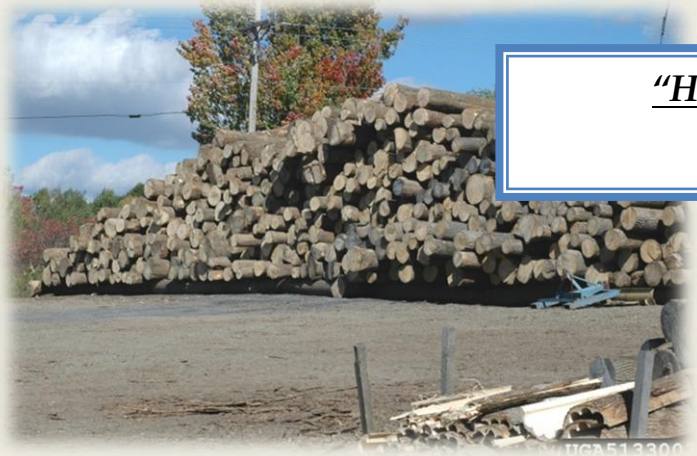


Chart 8. Average prices for cordwood and sawtimber (2007).
Source: Timber Mart North, George Banzhaf & Company, 8301 N. Allen Lane, Milwaukee, WI 53217

Table 4. Average weighted stumpage prices (adjusted for inflation to 2009 dollars) by year for Wisconsin.

Product	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average for all softwoods
Cordwood (per cord)	$27	$32	$30	$27	$25	$31	$37	$26	$17	**$18**	$26
Logs (per MBF)	NA	NA	NA	$34	$163	$14	$45	$69	$88	**NA**	$76
Christmas Trees	$8	$8	$4	$19	$16	$6	$8	$9	NA	**NA**	**NA**
Sheared Xmas Trees	$44	NA	$18	NA	NA	$58	$126	$105	NA	**NA**	**NA**

Source: Wisconsin Administrative Code Chapter NR46, 2000 to 2009



"How much balsam fir biomass do we have?"

Oven-dry tons by region of the state

There were 10.4 million oven-dry tons (ODT) of balsam fir biomass in 2008, a decrease of 6 million ODT or 37%, from 1983. This represents 1.7% of all live biomass statewide. As with volume, most balsam fir is located in northern Wisconsin (Chart 9).

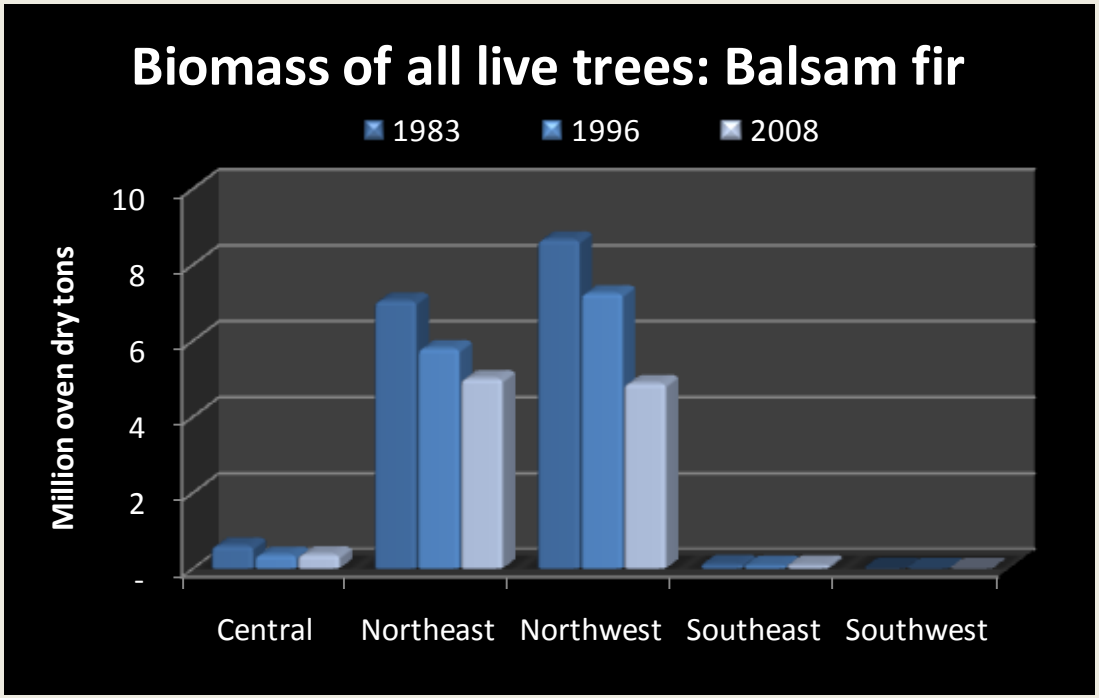


Chart 9. Biomass (million oven-dry tons) by year and region.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, and 2008

Balsam fir has the lowest density of any of the commercial species in Wisconsin, with a ratio of biomass to volume of 30.3 oven-dry pounds per cubic foot (ODP/cft). The average for all softwoods is about 34.3 ODP/cft and for all trees is 46.8 ODP/cft. Approximately, 79% of all biomass is located in the main stem and 16% in the top branches.

Additional tables:

Biomass by county in 2008 (pdf; Excel)